AN ECONOMIC APPRAISAL OF CONSERVATION AND DEVELOPMENT AREA AUTHORITIES PROJECTS IN SASKATCHEWAN:

Summary Report

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Report Prepared for

SASKATCHEWAN WATER CORPORATION
&
SASKATCHEWAN CONSERVATION AND DEVELOPMENT ASSOCIATION

DEPARTMENT OF AGRICULTURAL ECONOMICS
UNIVERSITY OF SASKATCHEWAN
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SUMMARY REPORT

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PREFACE AND ACKNOWLEDGMENTS

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1.0 INTRODUCTION

1.1 Background

Water is an important resource for human existence and for sustaining major economic and social activities of the modern civilization. However, its excess can be a problem, particularly as it affects a successful undertaking of major economic activities. In many parts of Saskatchewan, particularly in the northeast portion of the agricultural belt, excess rainfall and its concentration during the spring period, creates waterlogging problems on farms. In some cases, flooding of non-agricultural lands, including roads and other infrastructure, are also experienced, leading to major economic losses to producers and local residents, and loss of economic activity in the region.

These problems have been recognized by policy makers in passing a legislation in 1949. Called the Conservation and Development Act of Saskatchewan (1949), it provided for funding of rural water control projects in the province. The projects were needed to alleviate flooding and drainage problems associated with excess water on agricultural lands. In addition, some projects were designed to advance soil and water conservation, backflood irrigation and to stabilize levels of existing lakes through locally sponsored and co-ordinated programs. Assistance provided under the programs facilitated design, implementation and management of projects to control surface water flow within defined project areas.

Under this Act, some 91 individual Conservation and Development Area Authorities (CDAA) have been created[1]. These CDAAs have been active in establishing several hundreds of conservation and development projects across Saskatchewan utilizing various rural water control assistance programs. These programs were administered originally by the Saskatchewan Department of Agriculture, but in recent years by the Saskatchewan Water Corporation (SaskWater). The Saskatchewan Conservation and Development Association (SCDA) is an umbrella group of the individual Conservation and Development Area Authorities.

Although a variety of projects have been undertaken, a majority of them deal with draining the agricultural land of excess moisture in time for seeding of crops. Some projects also utilized the excess water, after storing, for irrigation. In some cases lakes were also affected by these projects, and were called lake level stabilization projects.

All projects are initiated by the local CDAAs. A case has to be made for the project, providing some evidence of the problem being encountered, and how it can be corrected. The government agency then investigates the request and provides a preliminary assessment and desirability of the project. Plans are then made to undertake survey of the affected area, followed by a period of construction activity, and then its subsequent operations period.

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[1] At th present time, there are 86 Conservation and Development Area Authorities and five Water Users Association.

Funding of these projects came from both public and private sources. The Government of Saskatchewan, initially through Saskatchewan Department of Agriculture, and later on through the SaskWater, contributed a portion of construction of these projects, while the rest being financed by the producers (and in some cases rural municipalities) affected by the project. In addition, the operations and maintenance expenditures for them are also shared between the province and the CDAAs. The CDAA funding is generated through a levy that is collected from all lands that would benefit from the project.

With respect to Rural Water Control Program Assistance, certain cost items are shareable while others are not. In addition, the cost-sharing arrangements have changed over time. These are shown in Table 1.

Table 1: Cost-Sharing Arrangement for Saskatchewan Water Control Projects

Activity	Percent of Total Project Activity Cost Paid by Government of Saskatchewan		
	Pre-1960	1976-92	1993-2002
Survey and Preliminary Design Work	100	100	100
Acquisition of Right of Way, Easements, and Other Authorizations	0	0	0
Construction Costs	75	66.66	50
Operations and Maintenance Expenditures	75	66.66	50

Services provided by the provincial government (through SaskWater) include investigational services and studies, and engineering and technical services. Similarly the local CDAAs are responsible for all costs associated with acquisition of right-of-way, easements and other authorizations and consents in connection with the construction of the proposed Rural Water Control works. The construction costs are shareable. Initially the split was 50:50 by the government and local CDAAs, which changed to 2/3 : 1/3 first and then to 75:25 in the more recent period. Maintenance expenditures are also shareable and currently these are shared equally between the SaskWater and the local CDAAs.

1.2 Need for the Study

Funds available through public sources (such as a government -- local or provincial) have multiple uses. Such funds must, therefore, require some allocation, based on how a particular use of these

funds achieves the goals of the government. Various users of these funds therefore, must compete with each other. Economic development and creation of jobs and prosperity for people are among the top goals of most governments. The public authority has the obligation to provide these funds for the best use, through ensuring that the investment is made such as to generate the most possible returns.

In the context of Saskatchewan, in order for the governments to identify and prioritize their spending of limited funds, it is necessary to find out if various types of expenditures (including those for the Rural Water Control projects) have the potential of generating benefits to the people of Saskatchewan, besides generating similar benefits for the people directly affected by the project. Every project has gainers and losers. In addition, some individuals may gain more than others, while others may not gain as much but may have to put up a higher portion of the costs. Nonetheless, evaluation of the effectiveness of public sector programs is needed to quantify the achievement of the expenditures made in the past. This information could be useful in shaping the program for the future years.

In the context of Water Control Projects, it is equally important to find out both from the public point of view, as well as from the point of view of the CDAA members, whether these projects have produced any benefits. This information may be useful:

- for counteracting any criticisms of public support of such projects;
- for the government agencies to guide and prioritize its allocation of available financial resources;
- for the agencies involved in the administration of these projects, a review of completed projects may generate potential ways of improving such projects in the future.

All this points out to the need for a review of these projects from time to time in order to ensure open and public accountability regarding achievements and impacts of expenditures as envisaged under the authorizing legislation.

Under the Saskatchewan Conservation and Development Act, variety of projects have been initiated. Since public funds are spent, it is necessary to evaluate whether such projects have created benefits for the people of Saskatchewan, and the distribution of such benefits within the society. In a similar vein, an assessment of the burden of the costs incurred is also needed. Since such an evaluation has not been undertaken, the present study was undertaken.

1.3 Objectives of the Study

In line with the foregoing discussion, the main objective of this study is to complete an economic evaluation of a sample of projects undertaken under the Conservation and Development Act of Saskatchewan. This investigation encompasses the following key activities:

1. Completion of a review of a sample of CDAA projects using information available from area authorities and the SaskWater;

2. Conduct an assessment of benefits and costs related to the project, and frame it in a benefit-cost analysis methodology;

3. Assess regional economic development benefits generated by the selected project activities using appropriate tool;

4. Identify in qualitative terms, and where possible in quantitative terms, the social and environmental impacts of the projects on the region and society; and,

5. Design appropriate criteria, based on results of the analysis, for selection of future projects by SaskWAter and SCDA (or local CDAAs)..

1.4 Scope of the Study

For this study 10 projects were selected and analyzed in details. Many of these projects have been in operation for 10 or more years. The results of this analysis are more like case studies, since projects were not selected using a random sampling framework. However, these do represent typical projects in the province. All of the projects studied had received planning, technical and financial assistance from the provincial government to facilitate project construction and implementation. Economic analysis of these projects in this study concentrated on the quantifiable financial measures. Although it is realized that economic development activities can produce significant social and environmental impacts, these were not a part of the focus of this study.

2.0 STUDY METHODOLOGY

As noted above, this report is based on an analysis of ten Conservation and Development Area Authorities projects in Saskatchewan. How these projects were selected and analyzed are described in this chapter.

2.1 Selection of Projects

At the outset, the research team wished to have virtually all projects that have been operating over 10 years included in this study. Since collection of data for such a large number of projects was a formidable task, and therefore, considered to be beyond the resources available for the study, an alternative way of collecting data was devised. A questionnaire was developed with the help of SCDA officials. It was field tested using the Brockington CDAA officials. A plea was made to the CDAA administrators attending the Annual SCDA Convention in Saskatoon in March 2000, to provide information on various projects under their jurisdiction using the questionnaire already developed.

By the end of summer of 2000, the response was somewhat poor, since only 7 questionnaires were returned. As a result a reminder was sent to various CDAAs to provide more projects. This had some success. In the final analysis 18 projects (including one for Brockington) were submitted. These projects were initially reviewed to see adequacy of the information provided for further analysis. Ten of these projects were found to have appropriate information, although some more details were still missing. A subsequent discussion with the local CDAA administrator completed the needed information for these projects.

In the final analysis, ten projects were given further analysis with respect to their effect on producers and other local people where these projects are located. Location of the projects studied is shown in Figure 1. Many of these projects are located in the Northeast part of the southern grain belt, although some projects were also from the southern part of the province. Location of the projects by the SaskWater regions and the local CDAA / rural municipality is also shown in Table 2.

In our opinion, the sample chosen for detailed analysis does not constitute a representative sample of the several hundreds of conservation and development projects existing in Saskatchewan. Nevertheless, the projects examined in this study are illustrative of the characteristics, costs and benefits associated with the array of projects in the province. The projects in the sample are geographically dispersed across the province, approximately in proportion to the distribution of conservation and development projects in various areas of the province. An example of this feature is the similar concentration of projects in the northeast and east central regions of Saskatchewan both in the sample and in the population of conservation and development projects.

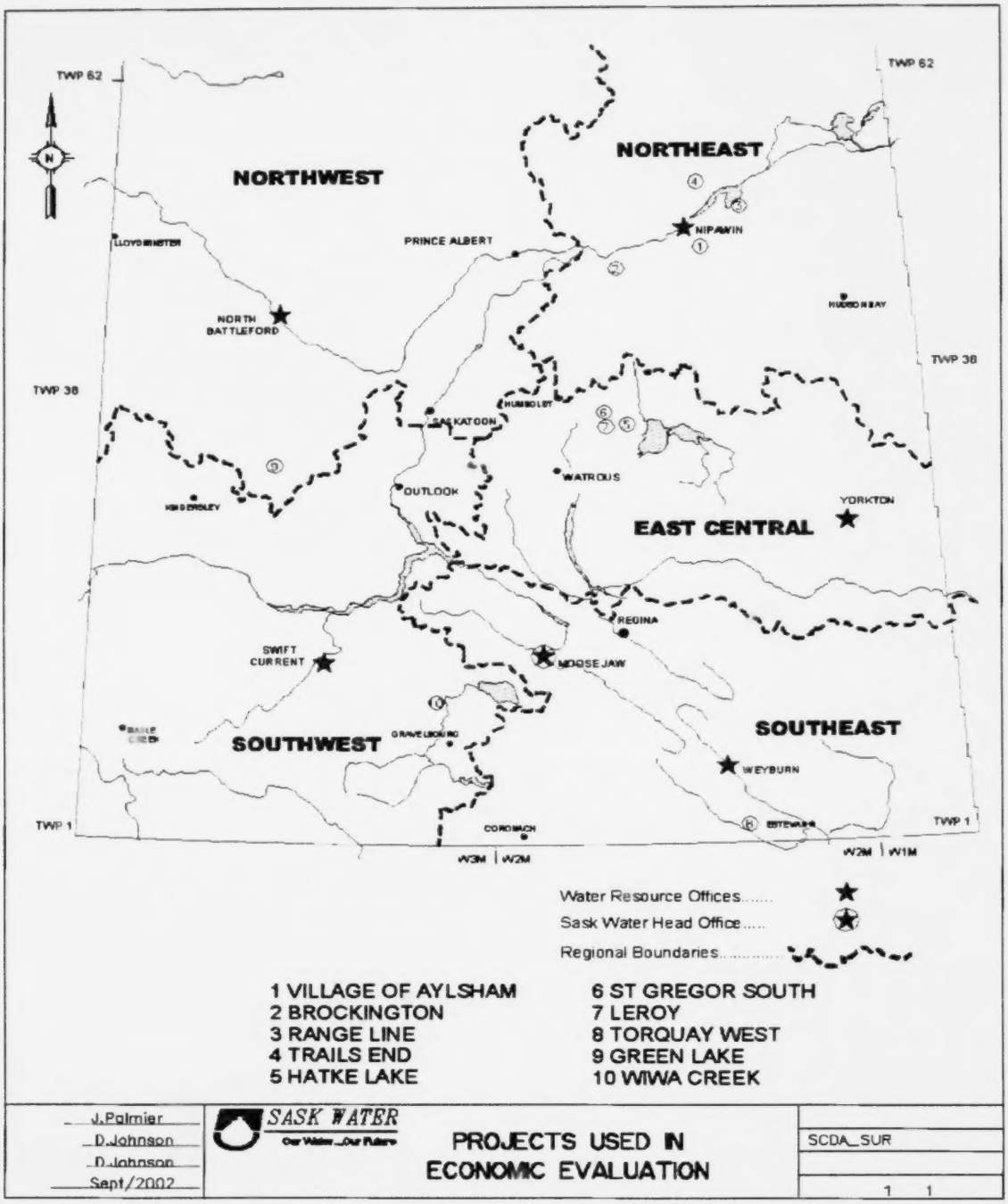

Figure 1: Map of Saskatchewan Showing SaskWater Districts and Location of Study Projects

Table 2: Salient Features of Study Projects

Project Name	SaskWater Region	Local CDAA	Rural Municipality	Major Purpose of the Project			Year of Operation Start	Productive Life of Project
				Agric. Drainage	Backflood Irrigation	Flood Control		
Aylsham Village	Northeast	Nipawin CDAA No. 101	457			X	1989	40
Brockington	Northeast	Lund CDAA No. 75	459	X			1985	30
Trails End	Northeast		488	X			1982	50
Ranch Creek	Northeast		369 & 399	X			1988	20
Hatke Lake	East Central		339			X	1979	50
Leroy West	East Central		339			X	1976	50
St. Gregor South	East Central		339 & 369			X	1982	40
Torquay West	Southeast		6	X			1985	30
Wiwa Creek	Southeast		104 & 134		X		1969	20
Green Lake	West Central		318		X		1973	50
All Projects	--	--	--	4	2	4		

2.2 Classification of Projects by Nature of Benefit

Sample projects were classified by the major purpose / nature of benefits generated by it. Results are shown in Table 2. There was an equal number of agricultural drainage and flood control projects. In addition, there two projects that had a backflood irrigation component in them.

A project was designated as an **agricultural drainage project** if the activities undertaken were related solely to draining the land within the project boundaries for agricultural purposes. Thus, the major benefits from these projects accrue to producers. A **backflood irrigation project** involves some agricultural drainage, but also putting that water back on land for agricultural purposes. A **flood control project** had agricultural drainage component as well as some flood damage reduction in the non-farming situation (community or infrastructure).

In terms of location of projects, four projects were in the Northeast SaskWater region, three in the East Central SaskWater region, two projects in the southwest SaskWater region, and only one project in the west central region of SaskWater. This distribution is very close to that of the number of CDAA in various regions of the province. Most of the flood control projects were located in the eastern part of the province – three in east-central SaskWater region, and one in the northeast region of the SaskWater. In contrast, both the irrigation projects were located in the western part of the province.

Selected projects have been in operation for at least 11 years at the time of study. The earliest project was in operation for 21 years. Water control projects typically have a long life. In fact, most CDAA were of the opinion that they will continue for ever if maintained properly. In such cases, project life was assumed to be 50 years. Other projects has a productive life between 20 and 40 years. Thus, investment in such projects once made can bring benefits over a long period of time.

2.3 Estimation of Project Benefits

Water control projects, particularly those related to drainage of agricultural lands, can bring forth several benefits to the producers, many of which translate into monetary gains. Thus, much of draining of land is motivated by economic reasons. A general criterion to decide whether or not to drain is whether drainage would pay for itself over time. These benefits may include, although not limited to:

- Improvement in the yield of various crops, through improved crop growing conditions. Earlier spring seeding, warmer soils in spring, increased soil air in root zone, increased availability of nutrient, are some of the factors that result in higher crop yields after drainage.

- Particularly under period of high crop prices, higher yields translate into higher gross returns from the land. This improves probability of a poorly drained parcel of land

increase in value. This may also provide some incentives to the producers to undertake the drainage.

- The workable acreage of the farm is increased through drying up the wet areas.
- Good drainage also permits more efficient machine operations.
- Improved gross returns and cost savings result in higher expected benefits from the parcel of land.
- On mixed farms, or on pastures, livestock may be healthier due to drier footing conditions.
- Management is easier because all fields can now be placed in a rotation, resulting in higher yields.
- The cumulative impact of the above set of changes is that the income flow from the parcel of land improves, and resultantly, the property value of the farm increases as well.

Although the above applies more to draining of poorly drained farm lands in general, many of these benefits are equally applicable to draining of land subject to frequent flooding.

Draining of lands can also create other effects, particularly on the people in the project region, as well as in the adjoining region, in addition to impacting biological and other natural resources. Less waterlogging in the area would ensure that excess rainfall would find its way to the natural outlets (lake, rivers, or creeks) in time, and would not create flooding. Washing out of bridges, roads and other transportation infrastructure are some of the examples of these reduced damages. In addition, draining of lands may affect the wildlife habitats, particularly those used by the waterfowl. Total net benefits from a water control project must therefore, include farm level benefits received by producers, as well as those for other members of the society.

Society benefits in other ways besides those benefits listed above. As producers are able to increase area under production, as well as achieve higher production levels, they need to purchase inputs from other industries. Higher production levels require more transportation and storage services, and thus create an increased level of economic activity in other industries. Creation of new jobs and resulting increased spending within the province can be a major boost to many rural communities within the province. As a matter of fact, a water control project can create a series of ripple effects in the economy, mostly through undertaking activities that are linked to other industries in the local area and in the province. In some cases, even the suppliers in other countries (mainly in the USA) could benefits from such project undertakings.

2.4 Method of Analysis of Study Project

Each of the ten projects in this study was subjected to two types of quantitative analyses, besides a qualitative analysis of its impacts. The quantitative types of analyses asked the following questions:

One, has the project contributed to the creation of new wealth in the Saskatchewan economy? This answer is obtained from estimating the cost of the project and benefits that have been generated from it. This method of analysis is called "Benefit-Cost Analysis".

Two, has the project generated new income or employment in other industries through undertaking of various project-related activities? This analysis is called the "Economic Impact Analysis".

The qualitative type of analysis was concerning the social and environmental impacts of the projects. Each of these analyses is described further.

2.4.1 Benefit-Cost Analysis

A benefit-cost analysis involves a systematic enumeration and evaluation of socially desirable and undesirable effects of a project. This type of analysis is undertaken for the purpose of comparing alternatives open to the decision maker, and using that information for ranking them. Thus, a benefit-cost analysis can assist the decision-makers in choosing among alternative means for attaining a particular goal.

This type of analysis is similar to the business plan or financial analysis for a producer as a guide for making new investment. The benefit-cost analysis is generally undertaken for projects where public funds are required.

In this analysis, various items of costs and benefits are identified, and measured, and eventually values in monetary terms. Since different project can last several years, and since different projects have a different life and stating date, a procedure of discounting is needed. Discounting basically involves converting the past and future values in today's dollars. As benefits occur in the more distant future, they become less and less important to the decision-maker.

Results of benefit-cost analysis are presented through three criteria. These are:

Net Present Value (NPV) of a Project: This is simply the total value of net benefits in today's dollars. Total cost of the project is deducted from the total benefits, both of course discounted first. This criteria can be interpreted as the present value of the income stream generated by the investment in a given project. A positive NPV of the project indicates that it contributes towards generation of new wealth in the economy.

A negative net present value of the project indicates that it is a burden on the society's resources, and should not be undertaken.

Internal Rate of Return (IRR): This measure is simply a measure of return on investment given the timing of costs incurred and benefits received by the society. At this rate of return discounted value of costs and benefits is exactly equal. If this value is greater than the discount rate that is used for the analysis, the project is deemed to be economically desirable. For example, if one can borrow money at 8% per annum, and the project can make a return of 15%, the project develop would have a gain of 7% after paying of the project.

Benefit Cost Ratio (BCR): This measure is obtained by dividing the discounted value of benefits by the discounted value of costs. A BCR greater than 1 indicates that benefits from the project are greater than the corresponding costs, and the project is economically desirable.

Each of these above three measures can be used to compare projects, and / or rank them in order of their economic desirability, in order to make a choice among those that can be constructed at a given point of time.

2.4.2 Economic Impact Analysis

When new economic activities take place, a number of changes begin to occur in the region as well as in the regions beyond. These changes could be economic in nature, and, as well, may have social or environmental connotations. The former is a subject for the economic impact assessment of a project. Impacts of a project are created through the existence of economic linkages among various businesses. Money received by one firm is spent on procuring its input requirements or paid to various factors of production. These lead to more economic activities in the region and are called secondary impacts. Estimation of total impacts (direct and secondary impacts) is the major focus of an economic impact assessment.

The economic impacts of the study projects were estimated using an input-output model. In this study, the model used was for that for the Province of Saskatchewan. Multipliers derived from the updated input-output model were used to measure changes in the economy. Indicators used in this study include the following:

Change in Economic Output: Economic output refers to the sale of goods and / or services produced by various businesses. These sales represent the gross value of the product produced and then sold subsequently. Through proper analysis, the model measures the change in the sales of these firms as a result of the project. This, the impacts estimated are new impacts.

Change in Household Income: Household income or family income is the amount of money received either as wages through paid employment or as profits of unincorporated farm and non-farm businesses. All these incomes are a result of new business activities generated by the project.

Change in Gross Domestic Product: Gross domestic product is a measure of the economic health of a region. It includes various types of incomes earned in the region (wages, salaries, and supplementary incomes), profits from unincorporated businesses, undistributed profits from corporations, and indirect taxes collected by the government. In addition, this measure includes the depreciation on various capital items used for producing economic activity.

Change in Employment: In order to undertake new economic activities, businesses must hire more workers. This results in higher employment in the region or elsewhere in the province. These workers are measured as full-time equivalent jobs. Thus, if a project hires 10 workers 3 month of the year, this will be equivalent to 2.5 full-time equivalent jobs.

These measures were estimated for each of the ten projects included in the study. In order to compare various projects for their regional economic development benefits, a new criterion was created: **Income Multiples for Investment** (IMI). It was created by summing the discounted increase in the household incomes from the project and dividing it by its discounted value of construction cost. The IMI criterion is comparable across projects since all values are in present-day dollars, and converting it to per dollar of capital investment removes the size of the project bias. This measure shows the number of times the initial capital cost is returned back to the society as income in the hands of people through project activities.

2.4.3 Social and Environmental Impacts

Some of the consequences of economic development projects are non-economic in nature. In fact, all economic development programs produce some positive and some negative impacts on the society and on the environment. Since such changes do contribute to the welfare of the society, their inclusion in the final appraisal of the project is important. Having said that, it should be noted that evaluation of social and environmental impacts of the conservation and development projects was not a part of the terms of reference for the present study. Therefore, in this study, these impacts were identified, wherever possible, during the project survey. These data were useful primarily for identifying qualitative implications, rather than converting them into quantitative impacts.

2.5 Data Collection for the Study Projects

Information used for conducting the analysis in this study was collected through a combination of the

approaches. The following ones were involved:

2.5.1 File Review

Many of the conservation and development projects potentially suitable for analysis were originally constructed under programs administered by the Conservation and Development Branch of the Saskatchewan Department of Agriculture, prior to formation of the Saskatchewan Water Corporation. Since much of the information in these files was not in electronic form, it was determined that a considerable human resource effort would be required to identify and manually extract relevant data and information from the files for purposes of this study. This approach was used in only a certain limited way by SaskWater authorities.

2.5.2 Focus Group Meeting

A pilot study of the Brockington project was conducted to test draft survey questions, and to determine the type and availability of data needed to conduct the analysis. The pilot study included a focus group meeting with members of the local CDAA Board. Various members of the local CDAA along with a SaskWater official were present at this focus group meeting.

2.5.3 Survey of Area Authorities

A survey guide was developed for purposes of conducting a survey of CDAAs. The guide was designed to collect historical data from files, as well as from past and current members of the CDAAs related to particular projects. Primary data to be collected included project construction and operating costs, as well as data on agricultural and non-agricultural benefits associated with the project.

2.5.4 Interviews with Area Authorities

The purpose of these follow-up interviews was to obtain additional, often more detailed, data on agricultural and land use practices under both 'without' and 'with' project conditions. In some instances, clarification of cost data as well as data on non-agricultural benefits was also sought from the local administrators of the CDAA in-charge of the project.

2.6 Study Assumptions

All the data collected through the survey or interviews with the CDAA official or SaskWater personnel were taken at face value. No other means of validation or verification of these data were

employed in this study. Other assumptions included:

1. The discount rate for the benefit -cost analysis is 5% and is appropriate for public sector projects.

2. Analysis was undertaken using farm level prices for various crops produced in the selected project regions for the 10-year period extending from 1991/92 to 2000/02.

3. Two different sets of technologies of production were used in the analysis: One, conventional tillage systems; and Two, conservation tillage system, including the minimum tillage and zero tillage. All project regions were assumed to have adopted conservation tillage to the extent shown in hte rural municipality in the 1996 Census of Agriculture.

4. Yield and input combination were obtained from appropriate Saskatchewan Agriculture and Food budgets (developed for crop planning) and assumed to be applicable to the project region.

3.0 DESCRIPTION OF STUDY PROJECTS

From an agricultural production point of view, several factors affect the economics of a drainage project involving farm lands. Similarly other attributes of the projects constructed also affect the overall economic desirability of the projects and the subsequent generation of its economic impacts. In this chapter, these features of the study projects are described. More details on each of these projects are provided in Pearson and Kulshreshtha (2002).

3.1 Soils and Rainfall

On the basis of nature of soils, the province of Saskatchewan is divided into three soil zones – each of which is represented by strips moving in a northeasterly direction. The southwest corner of the province is primarily brown soil zone. Only one project – Wiwa Creek is located in this region. Average annual precipitation in this region is around 300 mm (near the city of Swift Current). Mean evapotranspiration in the region of 576 mm (near Swift Current), which makes it a water deficit region. Availability of water for irrigation makes the area more productive for crops.

Moving in a northeasterly direction, the next layer of soil is the dark brown soil zone. Here two projects are located – Torquay West, and Green Lake West. The Torquay West project is located in the southern part of this soil zone, where potential evapotranspiration is higher (at 607 mm near Estevan), whereas the Green Lake project is located in the western part of this soil zone. In the Green Lake project area, precipitation is slightly lower (at 373 mm near North Battleford), but the annual water deficit is similar to the other project.

A majority of Water Control Projects studied are located in the black soil zone, and in a region where annual precipitation is between 450 to 500 mm, and the annual water deficit is only 70 mm. The excess moisture received in the region makes waterlogging a frequent occurrence, and drainage is a virtual necessity.

3.2 Nature of Activity Undertaken

In this section, each of the ten projects is described in terms of the major activities that were undertaken as a part of the water control project.

3.2.1 Aylsham Village Project

The Aylsham Village project is operated by the Nipawin Conservation and Development Area Authority No. 101. The project is located in the village of Aylsham and is classified as a flood control project. The purpose of the project was to reduce flooding problems in the village and on up-stream

farmlands. Discussions with local and provincial authorities on potential alternatives for resolving the flooding problems were initiated by the village of Aylsham in 1979.

The major activities undertaken through the project were widening and deepening of an existing drainage channel, construction of a railway bridge with associated drop inlets and relocation of utilities. The immediate project area involves 15 acres primarily within the village. The assessed area for purposes of project planning and operation consists of 47,166 acres, the area that land surveys indicated would benefit from improved drainage resulting from the project.

Before the project, the area suffered from delayed seeding of crops, lower quality of grains fetching a lower price, increased weed infestation, and reduced machinery operation efficiency, among others. Total crop losses were not typical (as shown in Table 3), although due to delayed seeding yield were 5% lower than the region's average.

Table 3: Flooding Frequency and Crop Loss during Pre-Project Period for Study Projects

Project	Total Crop Loss Frequency (Proportion)	Total Crop Loss Area in Acres	Severely Delayed Seeding Area in Acres	Moderately Delayed Seeding Area in Acres
Aylsham Village	0	0	0	47,166
Brockington	0.8	2,197	733	4,394
Trails End	0.9	732	800	3,028
Ranch Creek	0.8	1,094	2,560	0
Hatke Lake	0.2	830	0	6,523
Leroy West	0.8	2,800	0	8,400
St. Gregor South	0.2	7,064	0	49,452
Torquay West	0.9	665	0	651
Wiwa Creek	0.25	2,652	0	0
Green Lake	0.9	682	0	0

3.2.2 Brockington Project

The Brockington Flood Control project is operated by the Lund Conservation and Development Area Authority No. 75. The project is located northeast of Melfort, within the Rural Municipality of

Kinistino No. 459, centered in Townships 47 and 48 and Ranges 19 and 20, west of the 2nd Meridian. The project is classified as an agricultural drainage project. The purpose of the project was to reduce flooding problems on up-stream farmlands. Discussions with local and provincial authorities on potential alternatives for resolving the flooding problems began in 1976.

This project was selected as the initial pilot project under this study because it was considered to be a typical Rural Water Control Program assisted agricultural drainage project involving agricultural land. SaskWater staff provided data on project construction and operating costs as well as relevant dates for project construction.

The major work undertaken through the Brockington project was construction of a system of 22 miles of new or improved primary and secondary drainage ditches, drop control structures and road crossings. The network was designed to expedite and control the annual surface run-off from sloughs and other low lands towards the Saskatchewan River, thereby facilitating earlier spring cultivation and introduce other efficiencies in farming operations. The assessed area for purposes of project planning and operation consists of 7,324 acres, the area that land surveys indicated would benefit from improved drainage resulting from the project.

Conditions prior to the project construction, as shown in Table 3, included flooding of 2,197 acres of land, where the crop loss was 8 out of 10 years, on average. In addition, some 733 acres of land had reduced yield due severely delayed seeding, while on another 4,394 acres yields were reduced in a more moderate manner.

3.2.3 Trails End Project

The Trails End project is operated by the Torch River Conservation and Development Area Authority No. 65. The project is located in township 53, range 14W2nd in the Rural Municipality of Torch River No. 488. and is classified as an agricultural drainage project. The purpose of the project was to reduce flooding problems on the affected farm lands due to spring run off and heavy summer rains. Discussions with local and provincial authorities on potential alternatives for resolving the flooding problems were initiated by the Area Authority in 1975.

The major activities undertaken through the project were construction of an earthen drainage ditch, installation of culverts and drop structures, and acquisition of right-of-way. Some of the construction was on property owned by the rural municipality. The total area included within the boundaries of the project is 4,560 acres. A total of 3,924 acres are assessed for project planning and operation purposes, the area that land surveys indicated would benefit from improved drainage resulting from the project.

As shown in Table 3, flood frequency in this region was very high – in 9 out of 10 years crops were totally lost on some 732 acres. On the remaining area, delayed seeding caused yield losses and poor choice of crops.

3.2.4 Ranch Creek Project

The Ranch Creek project is operated by the St. Peter Conservation and Development Area Authority. The project is located in the Rural Municipality of St. Peter No. 369 and the Rural Municipality of Lake Lenore No. 399. The project is classified as an agricultural drainage project but with a significant drainage water containment purpose. The purpose of the project was to reduce flooding and salinity problems by increasing the capacity of an existing drainage channel to better contain increased quantities of drainage water flowing through the system from upstream land areas. Discussions with local and provincial authorities on potential alternatives for resolving the flooding problems were initiated with a petition by area farmers in 1986.

The major activities undertaken through the project were widening and deepening of an existing drainage channel, construction of bridges and culverts, and installation of drop structures. The assessed area for purposes of project planning, construction and operation consists of 35,000 acres. This is the up-stream water run-off area that land surveys indicated contributed to flooding and increased salinity problems along the 8-mile existing drainage channel.

During the pre-project period, every eight out of ten years, on average, witnessed the flooding of 1,094 acres of land. In addition, severe delays in seeding were observed for another 2,560 acres, which reduced the yield of major crops, on average, to 15% of the regional level.

3.2.5 Hatke Lake Project

The Hatke Lake project is operated by the Hatke Lake Conservation and Development Area Authority. The project is located in the Rural Municipality of Leroy No. 339. It is classified as a flood control project with a significant multi-purpose feature. The purposes of the project were to reduce flooding problems on up-land farmlands adjacent to Hatke Lake; and, to stabilize water levels in Hatke Lake and associated habitat to permanently accommodate waterfowl and wildlife in the area. However, as stated earlier analysis in this study was restricted to farm and non-agricultural changes.

Discussions with local and provincial authorities on potential alternatives for resolving the flooding problems were initiated with a petition by area farmers in 1975. The major activities undertaken through the project were construction of 7 miles of ditch, installation of culverts and crossings as well as construction of flax straw drop structures to control water erosion in the drainage channel. The assessed area for purposes of project planning and operation consisted of 10,544 acres, while the area assessed for construction was 7,353 acres, land area that surveys indicated would benefit from improved drainage resulting from the project.

The Area Authority reported that the situation prior to the project consisted of periodic annual flooding of farmlands due to excessive water from spring run-off and summer rains flowing into Hatke Lake from farmlands adjacent to the lake and in the up-stream drainage area. However, total crop loss occurred only in two out of ten years, and only on 830 acres (Table 3).

3.2.6 Leroy West Project

The Leroy West project is operated by the Leroy West Conservation and Development Area Authority. The project is located in Township 34, Range 20, west of 2nd Meridian and Townships 34 and 35, Ranges 19 and 20, west of 2nd Meridian in the Rural Municipality of Leroy No. 339. It is classified as a flood control project.

The purpose of the project was to alleviate flooding problems on farmlands in the area. Discussions with local and provincial authorities on potential alternatives for resolving the flooding problems were originally initiated with a petition from area farmers in 1951. Initial survey work was commenced at that time but then delayed until the early 1970's.

The major activities undertaken through the project were construction of approximately 10 miles of drainage ditches, installation of one crossing and construction of two drop structures. The town water line was deepened and insulated to accommodate the ditch. The assessed area for purposes of project planning was 11,232 acres while assessed area for project operation and maintenance is 9,618 acres. The area assessed for project construction purposes was 7,333 acres, the area that land surveys indicated would benefit from reduced flooding and improved drainage resulting from the project.

Prior to the construction of the project, flooding problem was extensive and frequent. Some 2,800 acres of farm land was affected, on average about eight out of ten years. There were also another 8,400 acres affected due to delayed seeding bu the effect on yield was not severe.

3.2.7 St. Gregor South Project

The St. Gregor South project is operated by the St. Gregor South Conservation and Development Area Authority. The project is located in Townships 34 to 37, Range 20 and 21, west of the 2nd Meridian in Rural Municipality of Leroy No. 339 and Rural Municipality No. 369. The project is classified as a flood control project. The purpose of the project was to alleviate flooding problems on farmlands in the area. Discussions with local and provincial authorities on potential alternatives for resolving the flooding problems were originally initiated with a petition from area farmers prior to 1974.

The major activities undertaken through the project were construction of approximately 26 miles of drainage ditches, installation of 20 rockford crossings and construction of 21 flax drop structures. The assessed area for purposes of project planning was 65,209 acres while assessed area for project operation and maintenance is 56,516 acres. Area assessed for project construction purposes was 5,000 acres, the area that land surveys indicated would benefit in the immediate short run from reduced flooding and improved drainage resulting from the project.

In terms of area, this is the largest project among those selected for this study. Flood frequency was

observed, on average, eight out of ten years which affected 7,064 acres of farm land, besides delaying seeding on another 49,452 acres of land.

3.2.8 Torquay West Project

The Torquay West project is operated by the Torquay West Conservation and Development Area Authority. The project is located in Township 2, Range 12, west of the 2nd Meridian in the Rural Municipality of Cambria No. 6. The project is classified as a agricultural drainage project. The purpose of the project was to reclaim for cultivation slough land subject to regular flooding problems from spring run-off and summer rains. Discussions with local and provincial authorities on potential alternatives for resolving the flooding problems were initiated with a petition by area farmers in 1983. The soil was tested and found to be suitable for annual cropping.

The major activities undertaken through the project were construction of a drainage channel and control structures. The assessed area for purposes of project planning was 727 acres while area assessed for construction, operation and maintenance consists of 651 acres, the approximate benefitting area from the project.

Before the construction of the project, there was a problem of serious flooding in the region. On average, nine out of ten years crops were wiped out on some 665 acres. In addition, another 651 acres were land was also affected by delayed seeding, although the magnitude of the reduction in yields was moderate.

3.2.9 Wiwa Creek Project

The Wiwa Creek project is operated by the Wiwa Creek Conservation and Development Area Authority No. 8. The project is located in the Rural Municipality of Gravelbourg No. 104 and the Rural Municipality of Shamrock No. 134. The original purpose of the project was to reduce flooding problems on low lying farmlands in the Wiwa Creek area. Subsequently, a backflood irrigation feature was added to the project as part of a broader plan resulting in the project being classified as a partial multi-purpose project with drainage and spring backflood irrigation features. Discussions with local and provincial authorities on potential alternatives for resolving the flooding problems were initiated by local farmers in the early 1950's.

The major activities undertaken through the project were initial construction of 4 miles of earthen ditch in an old creek bed, followed by construction of 17 miles of new ditch. Five main backflood structures were erected and many secondary dykes and control structures were built. The assessed area for purposes of project planning and operation consists of 2,652 acres, the area that land surveys indicated would benefit from improved drainage and irrigation resulting from the project.

The flooding problem was created, in part, by construction of drainage channels on up-stream

farmlands over the years prior to implementation of the project. Flood water came at regular frequencies from both Wiwa Creek and upstream flowing well systems. The Area Authority considered that no other adjacent upland farm land area would benefit from a future drainage project, since most of the upland normally drained into the creek.

Farm land in the area typically subject to 100% crop losses due to flooding, at an estimated frequency of 1 year out of 4, totaled 2652 acres. Land use prior to the project would typically consist of a 50:50 wheat-summerfallow rotation when excess water did not flood out the crop. No spring backflood irrigation was possible prior to the project because of the absence of necessary water control structures.

3.2.10 Green Lake Project

The Green Lake project is operated by the Green Lake Conservation and Development Area Authority. The project is located in the Rural Municipality of Mountain View No. 318. The project is classified as a agricultural drainage with some backflood component built into it. The purpose of the project was to drain the lowland known as "Green Lake" so it could be brought under cultivation without threat of frequent flooding. Discussions with local and provincial authorities on potential alternatives for resolving the flooding problems were initiated by area farmers in 1966 with a first meeting of the Area Authority. The provincial government was approached for funding assistance in 1968.

The major activities undertaken through the project was construction of a main ditch, short laterals to drain spring and summer run-off water from the lake and a control structure. Subsequent earthwork was undertaken to control slope failure and upheaval in the ditch. The assessed area for purposes of project planning, construction and operation consists of 682 acres, the only land area considered by the Area Authority to benefit from improved drainage resulting from the project.

Farm land in the lake area typically subject to 100% crop losses due to flooding, at an estimated frequency of nine years out of ten, totaled 682 acres. Flax would commonly be produced on the land in years when excess water did not flood out the crop. Adjacent uplands would normally drain into the lake and water would be trapped there without access to an outlet. Thus, the Area Authority considered that no other farm land area would benefit from a future drainage project, since the land already drained into the lake.

3.3 Cost of Development

Since various projects varied in terms of the area that can receive benefits from its construction, their cost of construction also varied, somewhat proportionately. As shown in Table 4, the most costly project among those included in this study was the St. Gregor South, and the least expensive among these is the Green Lake project. Since these projects were built at different times, their cost in

nominal dollars (money in the year it was spent) is not comparable. Therefore, these were converted into 2000 dollars. Cost per project varied between $179 thousand to $1.22 million, with average being $444 thousand. Average maintenance expenditures on these projects also varied from project to project, the average being $4,141 per annum.

Table 4: Construction and Average Maintenance and Operations Cost, Study Projects

Project	Construction Cost in Nominal Dollars	Construction Cost in 2000 Dollars	Average Cost of Maintenance and Operations (2000 Dollars)
Aylsham Village	$309,000	$401,530	$1,250
Brockington	$567,328	$803,897	$5,907
Trails End	$240,979	$415,816	$2,331
Ranch Creek	$273,300	$345,610	$4,500
Hatke Lake	$204,519	$372,348	$3,478
Leroy West	$163,474	$364,273	$3,144
St. Gregor South	$814,515	$1,219,884	$10,000
Torquay West	$279,500	$395,832	$1,800
Wiwa Creek	$134,727	$269,660	$7,384
Green Lake	$53,408	$178,800	$1,613
Average		**$440,338**	**$4,141**

3.3 Impact of the Project

All projects were successful in alleviating the producers of the problems faced in terms of waterlogging and floods (total crop wipe outs) as well as reduced productivity. A summary of the improvements brought about by these projects is shown in Table 5. Magnitude of this improvement differed from project to project. The Aylsham Village and the St. Gregor South projects brought about an improvement in the yield of crops grown over a larger area, St.Gregor South, Leroy West and Wiwa Creek reclaimed a relatively larger area either from waterlogging or salinity. On average, the projects included in this study reclaimed 1,872 acres per project as new area for production of

crops in the region. Similarly on average, 12,297 acres of land per project received improvement in crop productivity because of the projects.

Table 5: Impacts of the Project on Agricultural and Other Economic Activities

Project	New Agricultural Area in Acres	Improved Crop Productivity		Non-Agricultural Flood Damage Cost in 2000 Dollars
		Area in Acres	Magnitude of Yield Improvement	
Aylsham Village	0	47,166	5%	$60,000
Brockington	2,197	4,393	10%	0
Trails End	732	3,828	10%	0
Ranch Creek	1,094	2,560	15%	0
Hatke Lake	830	6,523	10%	$3,000
Leroy West	2,800	8,400	10%	$6,000
St. Gregor South	7,064	49,452	10%	$10,000
Torquay West	665	651	10%	0
Wiwa Creek	2,652	0	--	0
Green Lake	682	0	--	$4,000
Average	**1,872**	**12,297**		

Five of the projects – Alysham Village, Hatke Lake, Leroy West, St. Gregor South, and Green Lake, included in the study reduced flood damage on non-agricultural properties. These damages were associated with homes in the Aylsham Village, railroad in the case of Leroy West, and roads for the other two projects.

For each of these ten projects, economic (benefit-cost analysis and economic impact assessment), and social and environmental analysis were undertaken. These results are described in the next chapter.

4.0 RESULTS OF ECONOMIC ANALYSIS

All projects were subjected to three types of analyses: One, estimation of economic benefits and costs related to the project using the benefit-cost analysis framework; Two, estimation of economic impacts of the project; and Three, qualitative analysis of any social or environmental impacts of the project. Each of these is described below.

4.1 Results of Benefit-Cost Analysis

As noted earlier, benefit-cost analysis is performed to investigate the economic desirability of investment projects. All economic benefits from the project are identified and measured. These are then converted into monetary values. Since these may occur over a period of time, the monetary values are discounted. In this study, the discount rate used was 5%. The results are presented using the following three criteria: (1) Net Present Value (NPV) of the project; (2) Benefit - Cost Ratio (BCR); and, (3) Internal Rate of Returns (IRR).

Table 6: Economic Benefits and Costs Related Criteria for Study Projects

Project Name	NPV in Thousand $	Benefit-Cost Ratio	Internal Rate of Returns (%)
Aylsham Village	$2,933	4.39	33.08
Brockington	$701	1.58	9.81
Trails End	$395	2.17	11.11
Ranch Creek	$561	2.55	22.30
Hatke Lake	$620	2.28	13.64
Leroy West	$897	1.60	12.18
St. Gregor South	$4,808	3.72	19.70
Torquay West	$117	1.30	7.37
Wiwa Creek	$951	3.38	30.02
Green Lake	$323	2.56	15.23

Results for the above three criteria for the sample projects are shown in Table 6. Projects are evaluated using the NPV criterion, which illustrates the new wealth created by the project as additional benefits over and above costs for the project. As noted above, in this calculation a discount rate of 5% was used and the average of past 10-year prices for various crops were the basis for valuing the on-farm benefits. Results were also estimated for the other two criteria -- Benefit-Cost ratio, which illustrate the benefits per dollar of cost, and the Internal Rate of Return – a measure of return on every dollar spent on the project.

This analysis suggests that all the projects that were analyzed in this study passed the economic desirability test. In all cases were the benefits from them to producers and / or other members of the society were higher than the cost of construction and maintenance of these projects. The largest contribution to the economic benefits is made by the St. Gregor South project. This project is estimated to have contributed $4.8 million over its entire life. One should keep in mind that this estimate is based the situation when only the farm level and other economic benefits are counted Incorporation of social and environmental benefits or costs may provide a different picture, which has not been ascertained in this study.

Aylsham Village is the next best project in terms of additional wealth created by a water control project. This project contributes some $3 million over its entire productive life. However, based on the other two criteria, this project provided the best return for the money spent in water control projects. The rate of return is estimated to be 33%, and a benefit-cost ratio of 4.39. Thus, if the money for investing into this project can be borrowed at 8%, there is still a return of 25% to the society as a whole. Every dollar spend on this project, over its productive life makes a return of $4.39 to the society.

If one ranks these projects on the basis of the benefit-cost ratio or internal rate of return, most desirable projects include: Aylsham Village, Wiwa Creek and Ranch Creek with over 20% rate of return from their respective investment and operations. The reason for such a high rate of returns for the Alysham Village is the non-agricultural flood damage reduction. Wiwa creek produced a higher return primarily because of backflood component, which enhances the on-farm productivity of the project. On the lower end of scale are the projects such as Torquay West, Brockington, and Trails End. These projects have created mostly agricultural benefits.

4.1.1 Effect of Nature of the project Activity

Does the economic desirability of a water control project differ according to the nature of the project. To answer this question, projects were divided into three types: Agricultural drainage projects, Backflood Irrigation projects, and Flood Control projects. Results are shown in Figure 2 for the Internal Rate of Return and in Figure 3 for the Benefit-Cost Ratio criterion.

One of the inescapable conclusion of this comparison is that nature of the project activities does make a difference as far as economic desirability is concerned. The backflood irrigation projects are the best type of projects if one uses the internal rate of return criterion. The next economically desirable projects are those with flood control (agricultural drainage along with some non-agricultural flood damage reduction). Agricultural drainage projects (those did not have any other benefits to the society other than improving the economic position of farmers), had the lowest return on investment to the society as a whole. The benefit-cost ratio criterion, as shown in Figure 3, suggested that backflood irrigation projects and flood control projects had almost identical economic desirability. Thus, those projects that only provide farm level benefits to the producers are not as desirable on

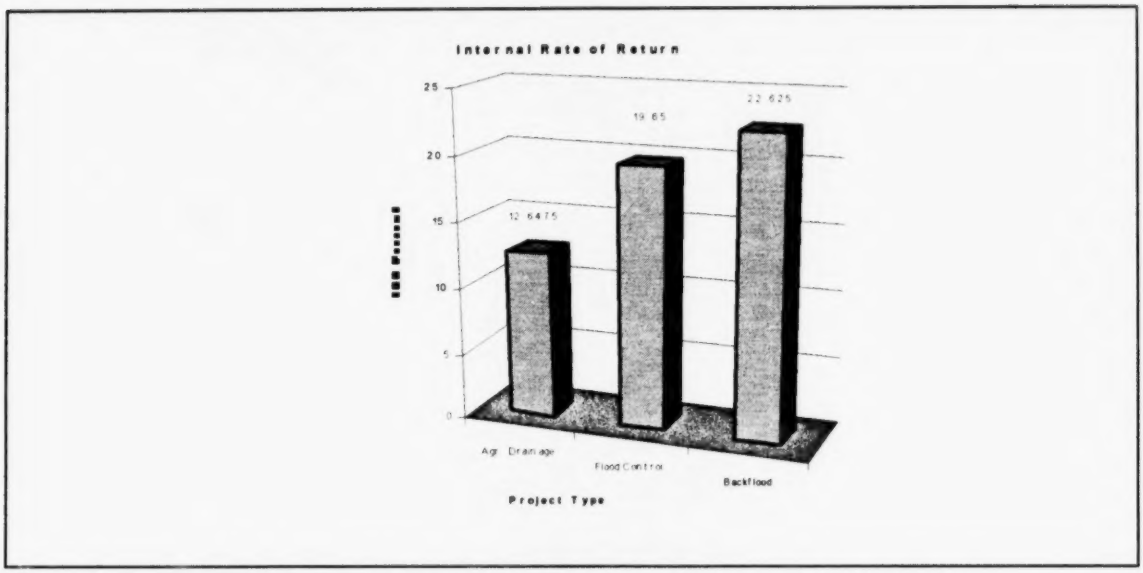

Figure 2: Comparison of Internal Rate of Returns by Type of Study Project

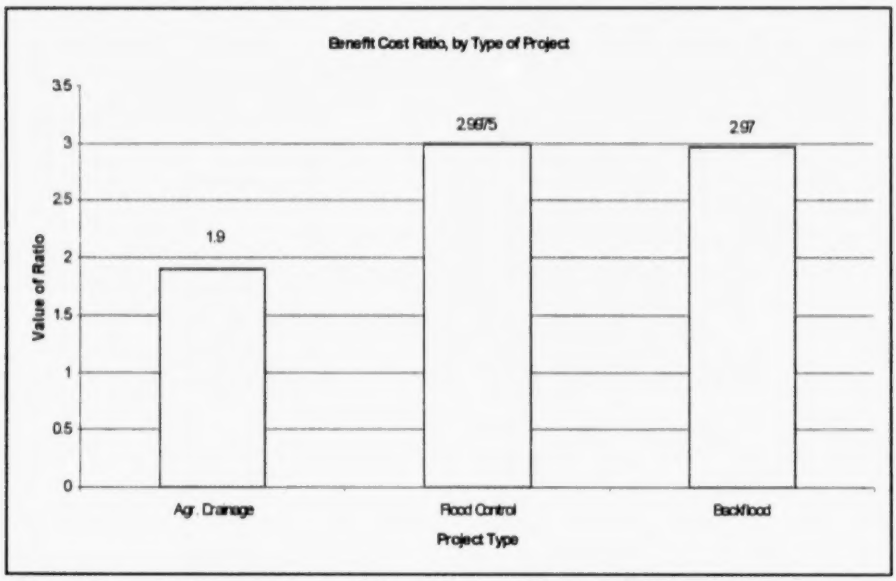

Figure 3: Comparison of Benefit-Cost Ratio of Study Projects, by Type of Project

economic grounds as others that incorporate some additional aspects either through irrigation development, or reducing flood damage to non-agricultural properties.

One should be careful in interpreting these estimates. In many projects, effect on the ecosystem were noted, but not incorporated quantitatively in this analysis. Thus, the above result do not truly reflect the social welfare of the Saskatchewan society. If these environmental impacts are negative, the results might be overestimating the social worth of these projects. However, this issue is left for future investigations.

4.1.2 Economic Returns and Cost of Development of a Project

What other characteristics of the projects could affect the level of benefits from them over and above their costs, and thus the magnitude of their economic desirability? In this section, we have selected the cost aspect of the project. One could easily see if the cost of building project were high, unless the level of benefits from it is also very large, its economic desirability would be lower. The major cost associated with a project is its construction cost. For this purpose, therefore, only the initial construction cost was considered. Since projects are of varying size, these costs were converted to a comparable criterion – construction cost per acre of affected area. Results are shown in Figure 4.

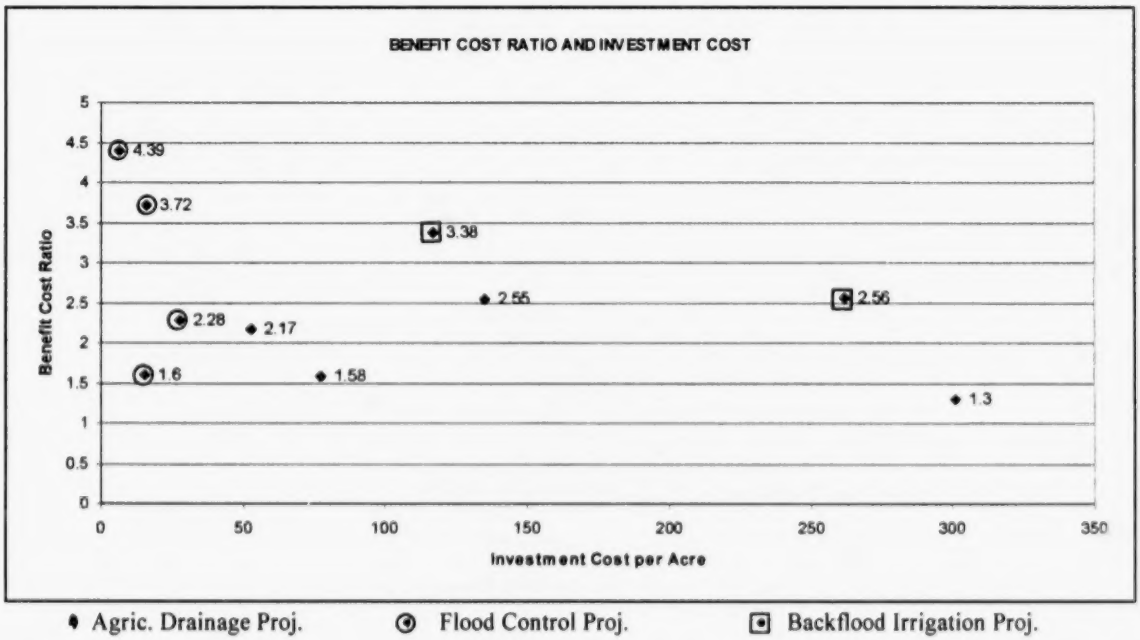

Figure 4: Relationship between Economic Desirability and Cost of Development, Study Projects

When the estimated benefit-cost ratios for a project were examined against the investment cost of the project, initially no clear pattern emerged. The nature of project, as shown in Figures 2 or 3, was superimposed. Generally speaking, projects with lower investment cost yield higher benefit-cost ratios, which is to be expected on theoretical grounds. Among the flood control projects, lower the investment cost, higher was the benefit-cost ratio for the project.

In addition to project's construction costs, two other characteristics of projects were examined. These were the farm level returns, and project size. Generally speaking, since most projects involved farm level production changes, higher the level of on-farm benefits (on a per acre basis), higher would

be the benefit-cost ratio for that project. Having backflood irrigation as a part of the project enhances this effect, although if the project has a higher non-agricultural flood damage reduction, these project were more desirable on economic grounds. These results are shown in Figure 5.

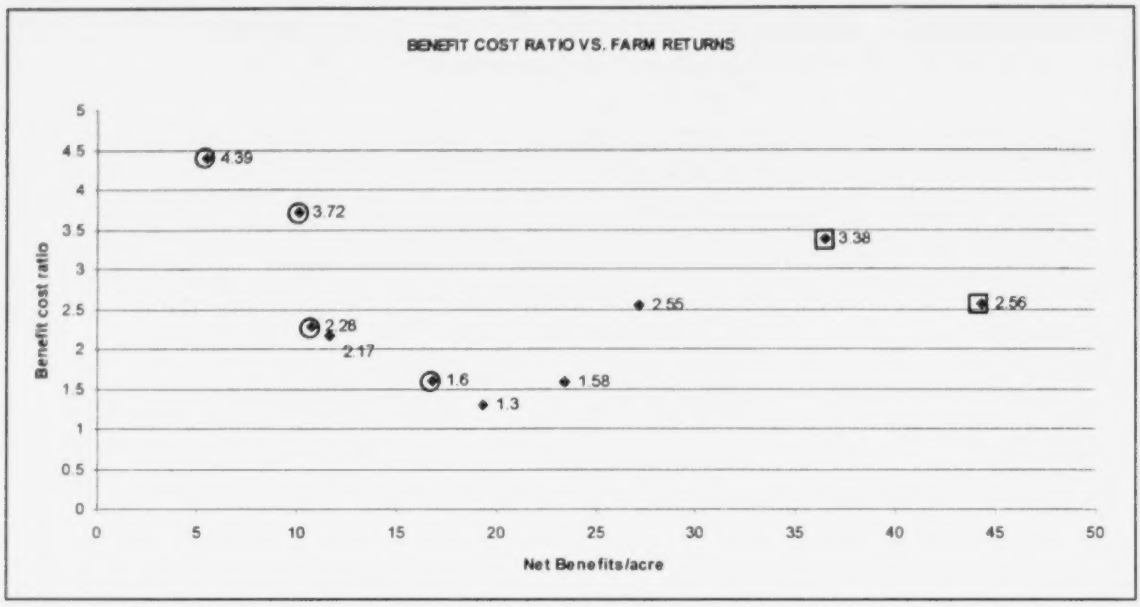

Figure 5: Level of Improvement in Farm Level Benefits and Project's Economic Desirability

The other factor that was used to identify the effects of project differences on its economic desirability was the size of the project. Since most projects had provided benefits to the agricultural producers, a common way to measure the size of the project was the area that was improved by the projects. When internal rate of return for various projects were plotted against this project size, a clear discernible effect of this factor was not obvious.

Thus, it appears that economic desirability of a project is enhanced if it contains additional benefits, such as irrigation or non-agricultural flood damage reduction. Cost of developing a factor has quite an effect on it overall economic desirability. In this day and age when funds are not plentiful, this criterion seems to have some intuitive appeal in making the final selection of the project for the water control projects.

4.2 Results of Economic Impact Assessment

As projects are built in a region, many new activities begin to take place. For example, decision to

proceed with a project is closely followed by developing a preliminary design, and survey of the region where project would be located. It is important to know what land area will be benefiting from the project – an information very necessary for calculating the levy on producers. This type of activity is typically undertaken by SaskWater, thereby providing employment to professionals in this area, who receive wages for the job. These wages have to be spent, some of which locally, while others on products that are not locally produced and therefore, have to be imported. This activity increase the sales of local businesses, who place new orders with the distributors and eventually to the manufacturers. The increased demand for goods enhances the process of manufacturing, transportation and storage of these products. Each of these activities would create more value added, including income to the workers who now have to be employed to supply the goods.

As one see from the above discussion, a simple decision by someone in our complex economy has some significant impacts on other businesses. Accounting for these impacts is the focus of the economic impact assessment. All of these impacts together help a local area or the province develop economically. Regional development benefits arise from the functioning of the economic system with various economic sector trading with each other.

4.2.1 Source of Economic Impacts

For each of the ten projects included in this study, major activities were identified that could be linked to the regional economic development impacts. For a typical project, these included the following activities:

- Construction of the project
- Expenditures incurred by the local CDAA in maintaining the project
- Expenditures incurred by the CDAA in major repairs or rehabilitation of the project
- Increase value of farm level production through:
    1. Increasing the land base for crop production
    2. Increasing the productivity of land though timely seeing of crops
    3. Improved productivity of land through reduced salinity or weed infestation
    4. Better selection of crops and agronomic practices
- Investment in farm machinery and other farm capital due to increased land base
- Reduced economic activity through less flood damage on non-agricultural lands

All of these impacts of a water control project were included in the analysis.

4.2.2 Level of Economic Impacts Created by the Projects

All the resulting impacts were totalled up for each project. Saskatchewan level impacts of the study projects are summarized in Table 7. Economic impacts are felt in terms of increased sales, added value to the economy of the province, higher income in the hands of workers and producers, and new

job opportunities. All these measures are included in the Table 7. Since a larger project requires more inputs, size has a significant influence on the magnitude of the economic impacts created by the project. In terms of increased sales, impacts varied from a small of $731 thousand for the Green Lake project to a high of $15.3 million for the Leroy West project. On average , the project included in this study contributed $5.2 million worth of increased sales of goods and services by Saskatchewan businesses, $5.5 million worth of additional gross domestic product fr the province as a whole, and $4.1 million worth of income in the hands of people of Saskatchewan. These impacts are over the life of the project, and therefore, are determined by the productive life of the investment. To standardize such differences, these values were converted into Net Present Value form, making a comparison more appropriate.

Table 7: Economic Impacts Related Criteria for Study Projects

Project Name	Net Present Value at 5% Discount Rate and 10-Year Average Prices in Thousand $			Employment in Full-Time Equivalent No. of Workers
	Sales of Industries	Gross Domestic product	Household Income	
Aylsham Village	$901	$4,256	$3,912	66
Brockington	$4,597	$3,336	$2,198	298
Trails End	$5,078	$4,887	$3,870	164
Ranch Creek	$5,530	$3,396	$2,262	53
Hatke Lake	$2,495	$3,490	$2,918	69
Leroy West	$15,303	$11,767	$8,571	482
St. Gregor South	$11,755	$16,219	$13,529	252
Torquay West	$3,739	$2,211	$1,418	40
Wiwa Creek	$2,014	$1,479	$1,072	56
Green Lake	$731	$2,283	$2,062	18
Average	**$5,214**	**$5,332**	**$4,181**	**150**

4.2.3 Economic Impacts and Project Size

Since the size of the project is a major determinant of regional economic development activities, larger projects should have a more positive influence on the regional incomes. To see if this is the

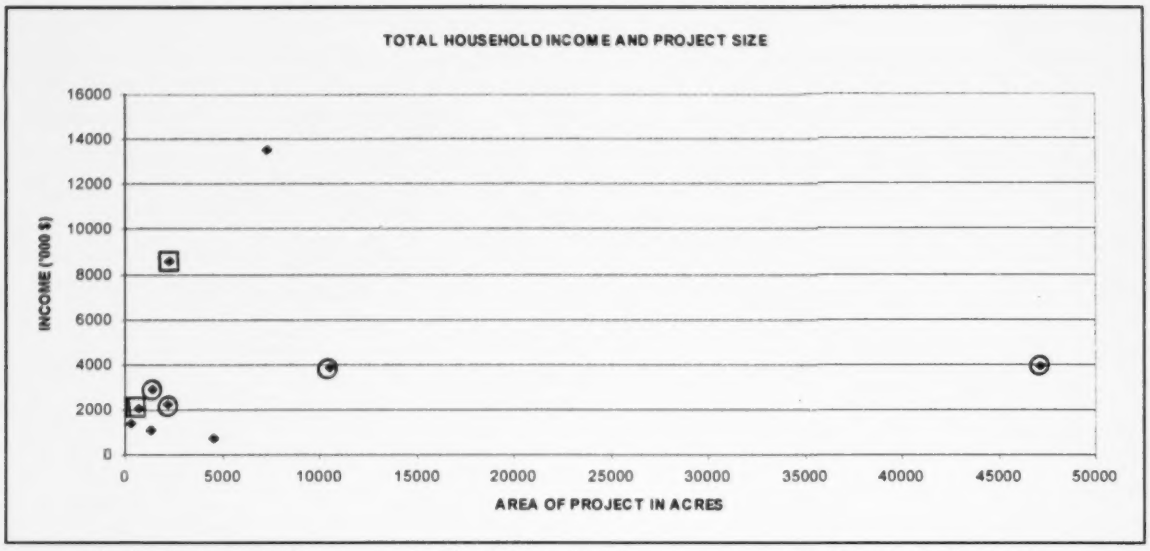

Figure 6: Relationship Between Impact on Household Incomes and Project Size

case or not, calculations were made for the household income – a criterion more meaningful in the context of society. Of course, the discounted value of income was used to ensure comparability from project to project. However, as shown in Figure 6, larger projects such as the St. Gregor South, Alysham Village, Trails End, and Green Lake projects, do not necessarily generate higher economic impacts. Thus, one could conclude that regional development impacts are more complex and are determined by other characteristics of the projects than captured by the size of the benefiting area.

4.2.4 Factors Affecting Economic Impacts of a Project

Analysis of economic impacts of the study projects was undertaken on lines identical to that for the economic efficiency evaluation. However, in order to bring some comparability, as noted in Chapter 2, a new criteria – Income Multiples for Investment (IMI) was created. This criterion indicates the number of times the original investment (construction cost) is paid back to the society by the project. It was measured as the ratio of the discounted value of the total household income generated by the project using a 5% discount rate and 10-year average prices, and the discounted value of the capital cost of the project in 2000 dollars. Estimated value of this criterion for various projects is shown in Table 8. The three top projects creating a large regional economic development are the Leroy West project, followed by the St. Gregor South and the Aylsham Village projects. The Leroy West project has a IMI value of 27.37, indicating that the construction of this project has generated income in the province over 27 times the money spent for its construction. Generally speaking, flood control projects generate more income relative to other type of projects.

Does the original cost have an influence on the level of the IMI criterion? Alternatively, is the IMI higher on projects that create higher level of on-farm productivity and related changes, leading to higher level of on-farm benefits. Results are shown in Figure 7 for capital cost of the project per acre, and in Figure 8 for net farm benefits on a per acre basis.

Table 8: Income Multiples for Investment Level for Study Projects

Project	Type of Project	IMI Value
Aylsham Village	Flood Control	14.59
Brockington	Agric. Drain.	3.89
Trails End	Agric. Drain.	12.00
Ranch Creek	Agric. Drain.	10.10
Hatke Lake	Flood Control	8.61
Leroy West	Flood Control	27.37
St. Gregor S.	Flood Control	14.99
Torquay West	Agric. Drain.	2.66
Wiwa Creek	Backflood	6.41
Green Lake	Backflood	6.74

From Figure 7, one can see that relatively inexpensive projects generate a higher turn-over of benefit (higher multiplier effect) than do the more expensive projects. Having said that, the nature of project has some role to play as well. Those projects that have some additional flood damage reduction on non-agricultural area seem to have a higher multiplier activity – more income generated per dollar of investment by producers and the Province of Saskatchewan. Such a pattern was not clear with respect to farm level benefits. Thus, projects with a higher benefits to producers in terms of net income do not necessarily create new activities and thus, new regional economic development benefits.

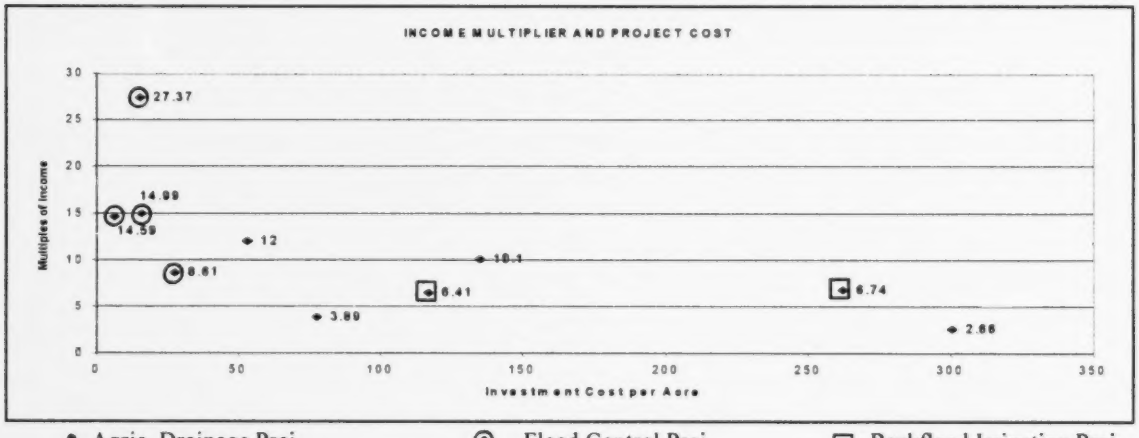

Figure 7: Relationship Between Income Multiples for Investment and Initial Project Construction Cost

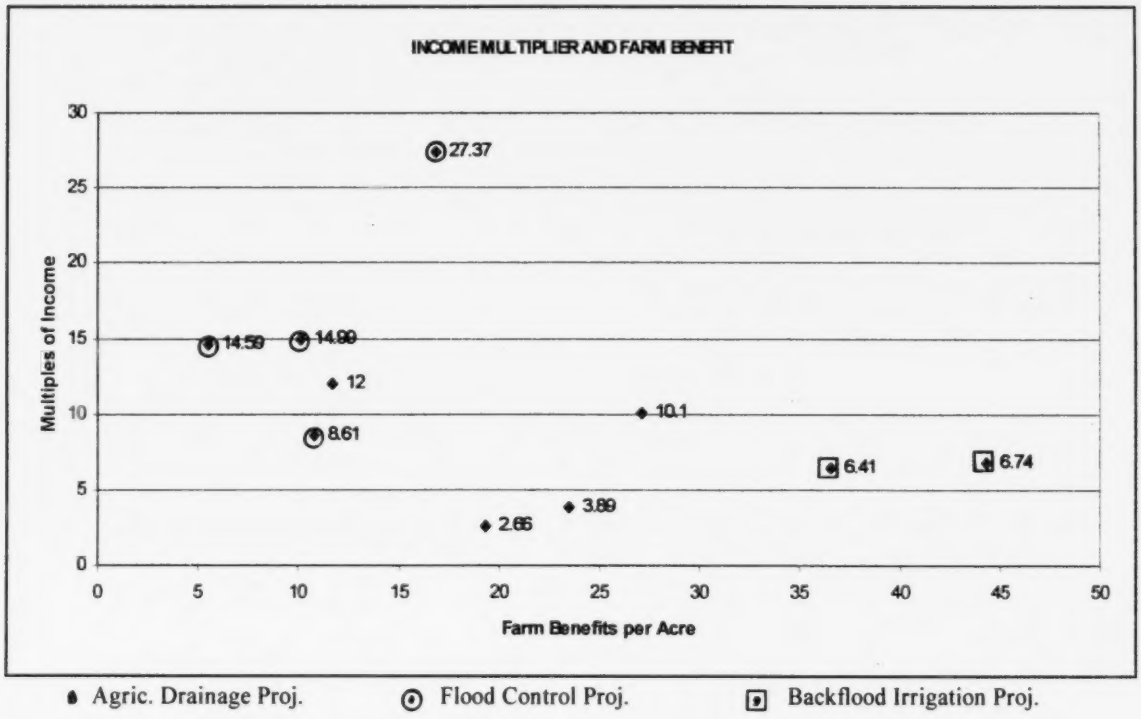

Figure 8: Relationship Between Income Multiples for Investment and Farm Level Benefits, Study Projects

4.3 Regional Economic Development Vs. Economic Benefits

Since members of the society prefer to have more jobs and income in their hands, regional economic development is of major concern to them. However, from the point of view of allocating scarce financial resources, public decision makers may prefer a project that can generate more new wealth – captured through economic desirability criterion, such as the internal rate of returns. Could there be a conflict between these two objectives?

To test for a possible conflict, we have plotted the economic desirability criterion of a project (Internal rate of returns) against the regional economic development criterion – Income multiples from investment (IMI). Results are shown in Figure 9. One of the impression that one can derive from this figure is that in most cases, higher the economic desirability of a project, higher is its regional economic development benefits. However, there were some exceptions. The relationship is not perfect. The Aylsham Village project that has the highest internal rate of returns does not produce the highest regional income multiples for the investment. Similarly the Leroy West project that has the highest IMI value does not generate the highest IRR.

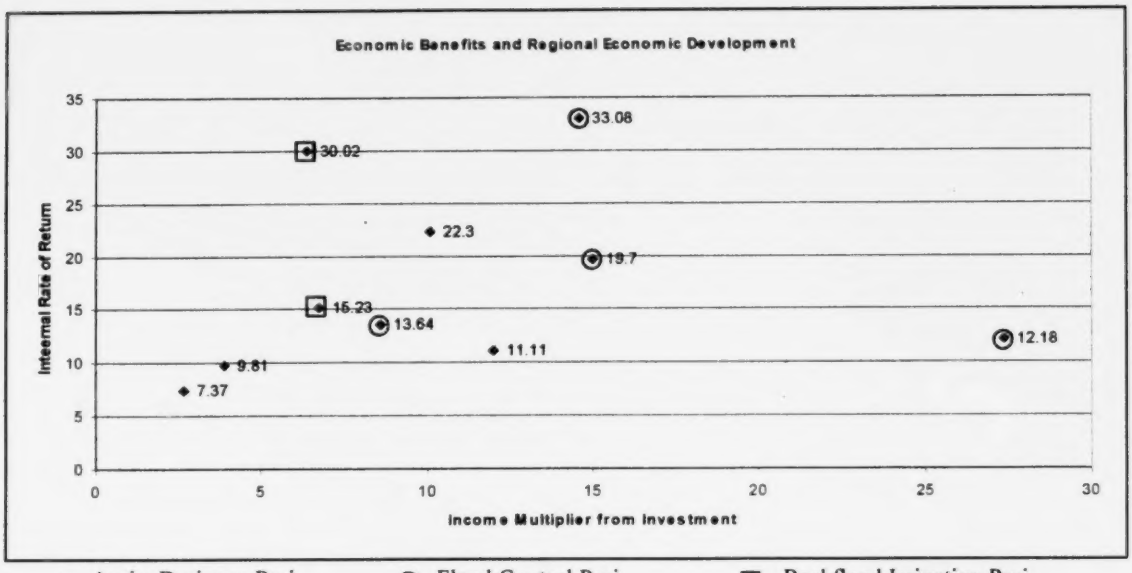

Figure 9: Relationship between Economic Desirability and Regional Economic Development Measures for Study Projects

4.4 Social and Environmental Impacts of the Projects

Based on discussions with the Area Authorities for various sample projects, very few projects were associated with any negative impacts on the regions in terms of social concerns or environmental goods, such as water quality, wildlife, and others. These responses are presented in Table 9. Two aspects of environmental goods were reported in the survey -- wildlife and waterfowl habitats, and water quality. In all projects, impact on water quality was nil or positive. Impact on wildlife/waterfowl habitats were reported only by four Area Authorities. This study cannot confirm or deny the authenticity of the responses shown in the this table. Naturally this requires a fresh investigation, involving an examination of the situation that existed before the project was implemented and comparing it against the present situation. Furthermore, past trends in the wildlife/waterfowl population and other factors affecting these habitats need also be taken into account.

4.5 Comparison of Study Results with Other Studies

Draining of farm lands is not a new activity. As early as 1859, producers in United States were provided with procedures to follow for draining lands. Various other provinces, notably Manitoba Agriculture, had also developed manual for farmers encouraging them to drain farm lands.

Table 9: Wildlife / Waterfowl Habitat Impacts of Study Projects

Project Name	Impact on Habitats	Impact on Water Quality
Aylsham Village	NO	NO
Brockington	YES (-)	NO
Trails End	NO	NO
Ranch Creek	YES (-)	NO
Hatke Lake	YES (+)	YES (+)
Leroy West	NO	NO
St. Gregor South*	NO	NO
Torquay West	NO	NO
Wiwa Creek	NO	NO
Green Lake	YES (-)	NO

* According to Duck Unlimited this project site has lost some habitats.

Positive results of on-farm benefits from draining agricultural lands in the prairies have been suggested by many studies. A recent Manitoba study by Slevinsky and Schallenberg (1990) estimated the on-farm benefits from drainage on Morris and Osborne soils in the order to $11 per acre. In Saskatchewan, a number of economic appraisals of flood control programs have been undertaken, although the reports are not available in a published format. Benefit cost ratio of 1.2 to 1.5 has been reported for the Beatty East Flood Control Project.[2] For Alberta, Apedaile (1987) examined the surface and sub-surface type of drainage systems in Alberta and concluded that sub-surface drainage systems were not viable on many farms when all farm costs, benefits and taxes are included. At the same time, role of policies (particularly stabilization policies or insurance policies) to protect landowners against reduction in the benefit stream through market place or natural disasters was found to be significant.

Most of these studies have looked at the on-farm economics of drainage from the private accounting stance. Such practices have been criticized by those concerned about environmental damage. It is claimed that undrained lands provide a number of ecological and societal services. These services

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2 Based on a memo by M. T. McIntosh to V. Geissler, Saskatchewan Water Corporation, December 2, 1985.

include the maintenance of water quality, stability of water flow, provision of wildlife habitat, and location for migratory stopover locations. Societal services include the provision of places for scenic appreciation, sites for recreation and tourism, and sources of local pride and prestige.

In order to make a valuation of all the benefits to the society from draining or not draining lands, a total economic valuation approach (one that is inclusive of farm level and non-farm level benefits) is needed. Such an approach to valuation of wetland preservation in Ontario has been reported by van Vuuren and Roy (1993). In their study, all agricultural benefits were included. In addition, for the society as a whole (excluding producers) preservation benefits included hunting, angling and trapping. Social net values exceeded from conversion of that wetlands to agriculture. The difference between the two set of value estimates were a result of including subsidies to drainage, property taxes, and inability of the landowners to extract payment for all preservation benefits. Thus, benefits from drainage may differ depending upon whether non-farm uses of drained lands are taken into account or not.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of the Study

This study has evaluated the economic efficiency and impacts of ten conservation and development projects constructed during the past 30 years in various areas of Saskatchewan. All of the projects received planning, technical and financial assistance from the provincial government to facilitate construction (i.e., most of the projects were constructed during a period of time when Saskatchewan Agriculture was responsible for administration of assistance for project design and construction; responsibility for these projects now resides with SaskWater).

The projects were selected for analysis based on data submitted by Conservation and Development Area Authorities in a voluntary survey undertaken during the initial stage of this study. Historic data were then projected into the future for the life of the project and converted to constant year 2000 dollars to provide consistency and comparability among projects for analytical and comparison purposes.

While not constituting a representative sample of the several hundreds of conservation and development projects existing in Saskatchewan, the projects examined in this study are illustrative of the characteristics, costs and benefits associated with the array of projects in the province. The projects in the sample are geographically dispersed across the province, approximately in proportion to the distribution of conservation and development projects in the various areas of the province. An example of this feature, is the similar concentration of projects in the northeast and east central regions of Saskatchewan.

The sample of projects examined are also illustrative of the main types of conservation and development projects existing in the province. For example, there are projects that are classified as single purpose drainage and flood control projects; some combine drainage and flood control features with a non-agricultural flood damage reduction features; others include back-flood irrigation features; and, one other project provides a lake stabilization feature combined with waterfowl and wildlife habitat enhancement features. There are no true multi-purpose projects in the sample but, when the projects are taken together, they illustrate most of the features that would exist in a multi-purpose project.

Each of the projects were analyzed using economic desirability criteria, using a technique called benefit-cost analysis, as well as regional economic development benefits through the application of economic impacts assessment methodology. These analyses examines the question whether results and impacts were consistent with typical expectations of efficiency and impact for such projects. It also provides answers to questions about whether the projects were worthwhile from the perspective of private beneficiaries as well as public beneficiaries, or society in general.

5.2 Study Conclusions

- Results of the analysis of the ten projects indicate that these projects, based on actual historic performance, have been relatively efficient in terms of utilization of private and public investment funds. In fact, based on the benefit-cost ratio calculations, all projects were found to be economically desirable. Rates of return have been competitive with or better than other investment alternatives.

- Some projects presented better results than others with major differences associated with the type of project (i.e., multi-purpose projects tended to yield higher results) and the magnitude of benefitting land relative to cost (i.e., lower investment cost per acre yield higher results). Based on results obtained in this study, some of the projects with lower rates of return likely would not have been constructed or would have been designed differently.

- Private benefits exceeded private and public costs in this study; however, there were several potential dis-benefits that could not be measured due to insufficient data (e.g., loss of waterfowl and wildlife habitat, etc.). It they could be effectively measured, social costs may challenge total benefits for certain projects.

- Historically the projects studied have had significant direct and indirect employment and economic impacts on the local and provincial economies. These impacts will continue into the future stemming from incremental economic activity (e.g., agricultural production, investment, project operation and maintenance, etc.) generated by the projects.

- Most of the projects did not indicate generation of benefits to third-parties, commonly called public goods. In fact, in these projects all benefits were captured by the private land holders or other institutions in the local (project) region.

5.3 Recommendations

Based on the economic analysis of these projects presented in this study, several recommendations are provided to facilitate conduct of future similar studies with respect to conservation and development activities within the context of future watershed management activities. These include:

1. Administrators of future conservation and development projects should include a systematic data collection component to ensure that key indicators on project performance and impact can be reliably measured at various stages during the life of a project.

2. A systematic database should be established and maintained, perhaps jointly by the Saskatchewan Conservation and Development Association and Province of Saskatchewan. This would facilitate undertaking a similar study of performance measurement indicators selected for future conservation and development projects. Reliable data for conducting the economic analysis is crucial, and such are not routinely collected by public agencies. Periodic use of the survey instrument developed in this study could be used for this type of activity.

3. The analytical models (benefit-cost analysis and input-output model) developed in this study could be readily adapted to facilitate future comprehensive watershed planning and management initiatives and to support multi-purpose project feasibility and impact analysis. While the models must be adjusted and customized to accommodate the unique features of each project, the principle steps involved in the calculations are the same for every project.

4. The Saskatchewan Conservation and Development Association and SaskWater should consider alternatives for communicating and sharing with other members of the society information developed in this study about the benefits and impacts of conservation and development projects. The results of this study indicate that conservation and development projects examined have had generally positive impacts on local farming operations in terms of reduced flooding and improved cropping. Quantitative data on agricultural benefits and impacts as well as estimated rates of return on investment are the types of information that would be of interest to local farmers and rural municipalities. This and other information could be useful to newspapers and others in preparing articles on success stories in rural Saskatchewan.

   The information could also facilitate more informed, positive discussions in the future with representatives of other resource management and environmental interest groups. It is evident from results of the analysis that there are significant economic advantages, in terms of both private and societal interests, in working towards design of multi-use projects within the context of comprehensive watershed management.

5.4 Guidelines for Future Project Selection

Although this study is based on a small sample, it does point out to some important guidelines. These guidelines are recommended for consideration of future water control projects:

- Projects should be subjected to an *ex ante* appraisal. Such an appraisal should encompass economic, social and environmental impacts of the project. To the extent possible, both economic efficiency and impacts related criteria should be included. Economic efficiency measures must also include non-economic impacts of the project.

- Water control projects that provide benefits (or at the same time do not destroy environmental services in the region) beyond the farm gates should be given a higher priority. This purpose would be best served through development of multi-purpose projects, which produce a range of private and public goods.

- Project capital and operating costs for water control projects should be shared in proportion to the ratio of public and private benefits generated by the project. If a project does not generate any direct public goods, it should not qualify for support by the public sector.

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